

Stack Heat Recovery, Adsorption Chilling Project



October 26, 2004
PIER Project: MR 03-10

Project Goals

- Determine feasibility of recovering fryer stack heat to reuse heat within the plant process.
- Determine the suitability of adsorption chilling for use in the food industry.
- Install a demonstration project using adsorption chilling and waste heat recovery to replace electrically driven plant cooling.
- Document operation and savings.

Basic Opportunity

- Frito Lay has had a ongoing effort to reduce overall energy costs at each plant.
- Fryers and ovens require large amounts of heat energy.
- Current technology results in a majority of the heat being lost to atmosphere via the exhaust stacks.
- Potato chip fryer stack temperatures of 212 to 230 degrees were found, mostly steam from evaporated water.
- The Visalia CA facility has a year round need for chilled water for their HVAC system. Peak summer demand of approximately 350 Tons/Hour was found.
- By the Summer of 2004, the project was completely designed and detailed cost estimates were completed, along with preliminary approvals from Frito Lay.



Heat Recovery – Fryer Stacks



- Source of waste heat for recovery
- Central to plant operation
- In use year round based on production schedule

Adsorption Chiller (150 ton)

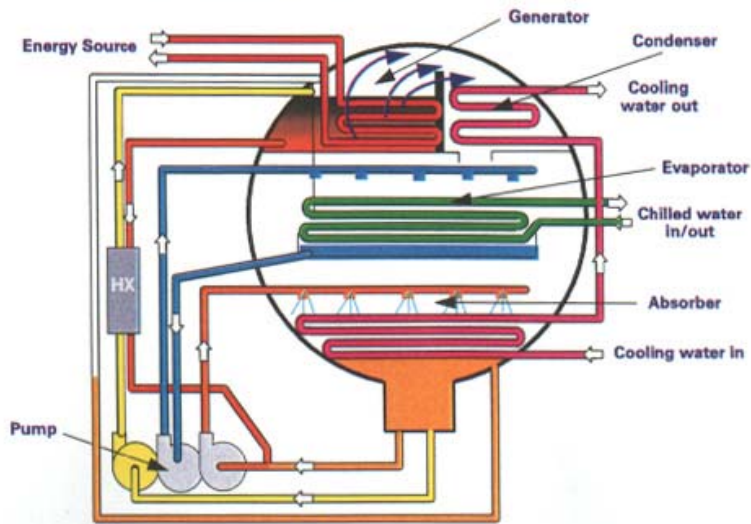


Adsorption vs. Absorption

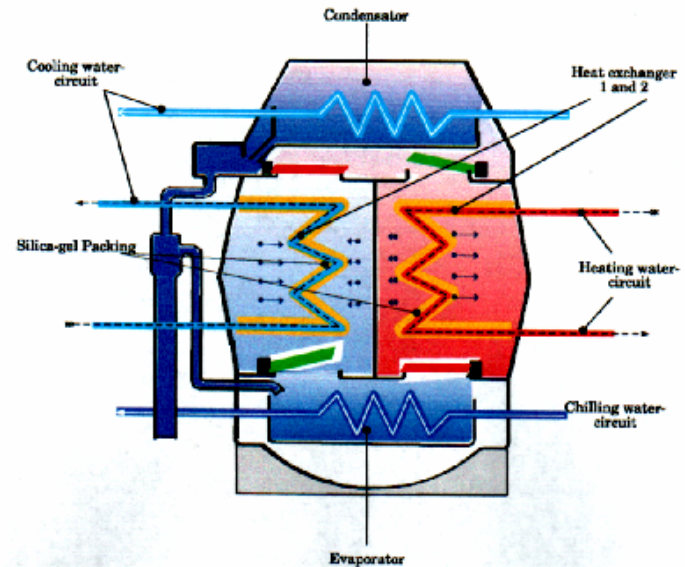
| | Adsorption chiller | Absorption chiller |
|------------------------|---------------------------|---------------------------|
| Refrigerant | Tap water | Distilled water |
| Adsorbant | Silica gel | Lithium Bromide |
| COP | 0.7 | 0.7 |
| Warm up time | 0-7 minutes | 30 minutes |
| Life expectancy | 30 years | 7 to 9 years |
| Minimum hot water temp | 122°F | 180°F |
| Chilled water temp | >37°F | >48°F |
| Corrosion issues | No | Yes |
| Turn down | 7 step automatic | Requires bypassing |

Absorption/Adsorption Chilling

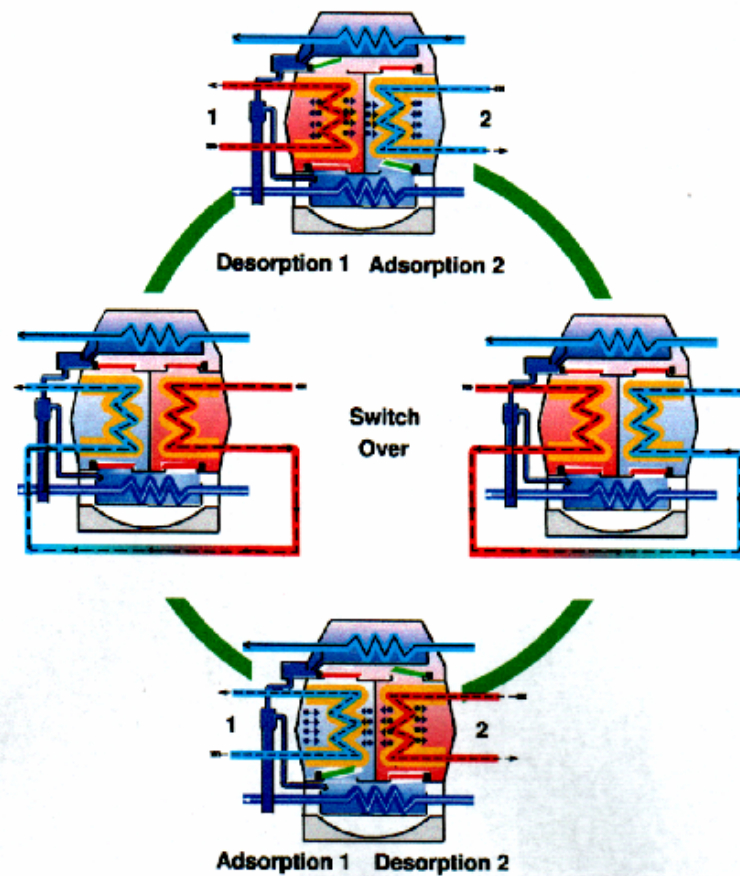
Classic Absorption Refrigeration Cycle



Low Temperature Adsorption Chiller



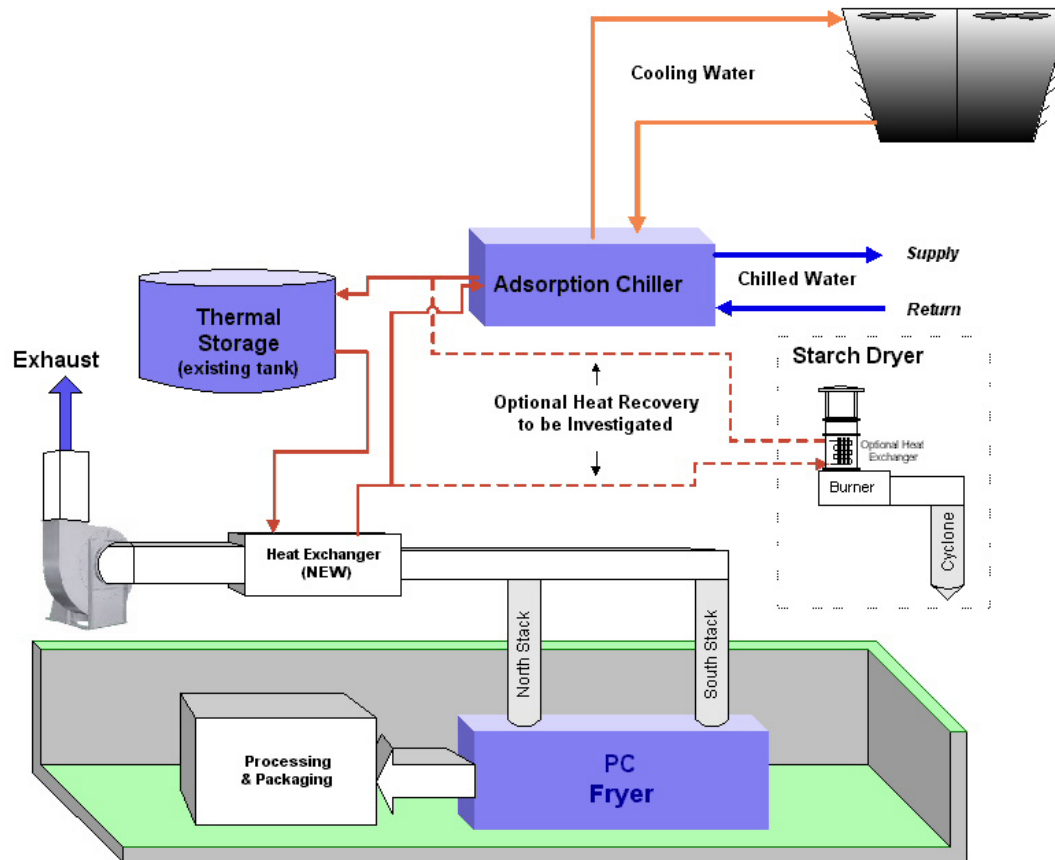
Adsorption Cycle



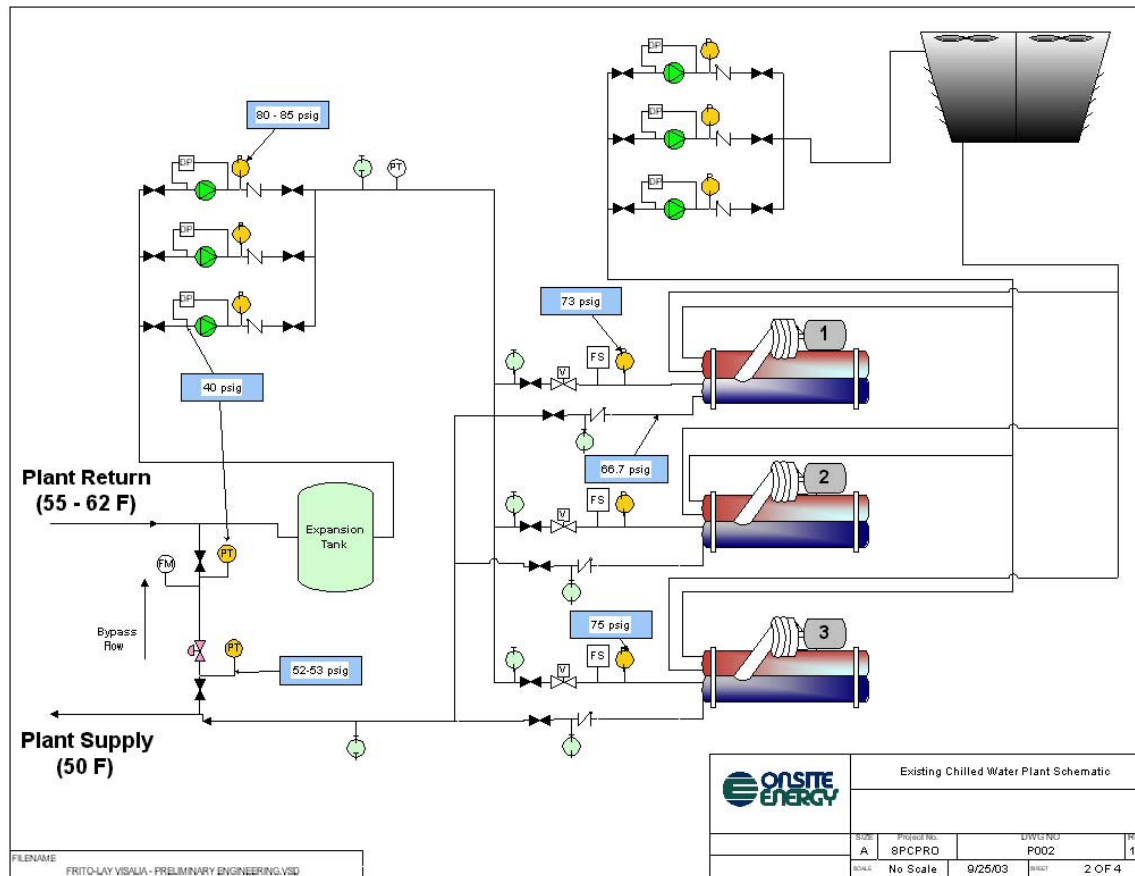
Proposed Process

- Recover heat from the fryer exhaust stacks
 - Tranter “Econocoil”
 - Heat and Control, HRS heat recovery unit.
- Hot water circulates to the Adsorption chiller
- Use auxiliary heater (steam) for start up or non fryer days.
- Chilled water circulates from Adsorption chiller to existing HVAC chilled water loop.
- Eliminates need for the plant electric chillers except on peak days. The potential exists for meeting all chilling demand.
- Project also looked at the potential for using extra waste heat for a starch drying operation.

Proposed System



Current Chiller System



Progress

- Established historical data records for chilling and fryer operations.
- Established baseline operating conditions for chillers to estimate year round loading based on ambient weather conditions.
- Performed stack tests for exhaust conditions on typical operating day.
- Established tentative heat values and potential process
- Design engineering was completed, reviewed with Frito Lay and updates made to meet plant needs.
- A heat exchanger manufacturer was chosen and was working on final heat exchanger design/performance and costs.
- The chiller manufacturer has arranged for an expedited delivery.
- Process design and the costing was complete and was in the Frito Lay approval process. In late September, Frito Lay decided to close the Visalia facility.
- Onsite is currently looking for an alternative site that has waste heat and a chilling load.

